Interventions & Clinical Skills:
Assessment, Stress, ECG, & ACLS

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NO CONFLICT OF INTEREST
To much of a good time!!

More vids @ HumorOn.com
I know CPR can I help?
Houston I think we have a problem?
Going to “Nuclear” for stress a test!
COMMON CARDIOVASCULAR SYMPTOMS

- Shortness of Breath
- Syncope
- Palpitations
- Claudicating
- Edema or weight gain
- Fatigue
- Back Pain
- Nause
- Chest Pain

CP--What is happening?
- Presentation
- Quality
- Region
- Severity
- Timing
PATIENT PROFILE

- Personal habits
- Life-style pattern
- Recent life changes
- Emotional state
HISTORY

- Chronic disease – HTN, MI, DM, Anemia, CVA, RF, CHF, valvular disease
- Family History
- Previous Hospitalizations, treatments, previous cardiac diagnostic procedures.
- Current health habits
- Medications
- Stress and coping skills
Evaluation of Patient

- Identify cardiovascular risk factors
- Labs (Troponin, K+, HCT, HGB)
- VS (BP, HR)
- Drug Levels (Digoxin, Quinidine, Inderal)
- Diagnostic Procedures (Echo, CT, MRI)
IDENTIFY CARDIOVASCULAR RISK FACTORS

- Gender/age
- Family history
- Hypertension
- Diabetes mellitus
- Obesity
- Smoking history
- High serum cholesterol
- Sedentary lifestyle
DIAGNOSTIC STUDIES

- Noninvasive Procedures
  - Chest X-Ray
  - EKG
  - Echocardiogram
  - CT
  - Magnetic resonance imaging

- Invasive Procedures
  - Cardiac catheterization
  - Coronary angiography
  - Peripheral arteriography or venology (i.e. translumbar arteriogram of femoral arteries)
Laboratory Tests – Chemistries/Drug Levels

- Troponin
- CK
- CPK-MB fraction
- Drug Levels (Digoxin, Quinidine, Inderal)
- Na
- K
- HGB
- HCT
Myocardial Perfusion “Stress” Test

EXERCISE (TMT OR BIKE) STRESS

PHARMACOLOGIC “STRESS” AGENTS:

- Adenosine (with exercise)
- Regadenoson (with exercise)
- Dipyridamole (Persantine) (with exercise)
- Dobutamine
EXERCISE (TMT OR BIKE)

- **Bruce or Hollenberg**
  - 85% age-predicted heart rate
  - 1.7 mph at 10% grade--advance stage - 3 min
  - At least 5 mins.

- **Modified Bruce or Sheffield**
  - 85% age-predicted heart rate
  - 1.7 mph at 0% grade
  - Use in patients with poor exercise tolerance

- **Bike**
  - 85% age-predicted heart rate
  - Double the Rate/Pressure product
Contraindications to Exercise

- **Absolute**
  - Acute myocardial infarction
  - Unstable angina
  - Severe congestive heart failure
  - Uncontrollable arrhythmia

- **Relative**
  - Certain Medication (Digitalis, Beta-blockers, and calcium channel antagonists, Nitroglycerin
  - Left ventricular hypertrophy
  - Conduction disturbance (LBBB, complete A-V block, and WPW)
  - Exercise limitations
Exercise

Indications for stopping test

- Reaching target heart rate with signs and symptoms
- Angina, fatigue, dyspnea, claudication, ataxia
- Development of typical ischemic ST-segment depression
- Development of ventricular tachycardia
- Drop in blood pressure
- Development of LBBB

"This is the stress test. Run until you start huffing and puffing."
PHARMACOLOGIC “STRESS” AGENTS

- Adenosine
- Regadenoson
- Dipyridamole (Persantine)
- Dobutamine
ADENOSINE

140 mcg/kg/min IV constant infusion for 4 mins. (6, or 7 minutes)

- Onset of action: immediate, transient, and dose related
- Time to peak effect: 30-60 seconds
- Duration of effect: about 154 seconds
- Half life: <10 seconds
- Almost completely eliminated after single pass through coronary circulation
Regadenoson

0.4mg/5 ml regadenoson (10 sec)/ flush with 5 ml NS----10-20 sec wait--- injection of radiopharmaceutical/ flush with 5 ml NS

- Onset of action: 30 sec
- Time to peak effect: 1 - 4 mins
- Duration of effect: Most adverse reactions begin soon after dosing and generally resolve within approximately 15 minutes, except for headache which resolves in most patients within 30 minutes.
- Half Life:
  - Initial phase - 2 to 4 mins
  - Intermediate phase – 30 mins
  - Terminal phase – 2 hours
CONTRAINDICATIONS

- Severe bronchospastic pulmonary disease
- Symptomatic hypotension
- Unstable angina
- Recent myocardial infarction (<2 days)
- Sick sinus syndrome
- 2nd or 3rd degree AV block
- Severe congestive heart failure

Drug Interactions:
Dipyridamole, Xanthines, Aminophylline
TERMINATING GUIDELINES

- **Hypotension**
  - 20 mmHg systolic fall—with signs/symptoms
  - Systolic pressure 80 mmHg

- **ST depression**
  - 3 mm beyond baseline ECG, without angina--DM
  - 2 mm beyond baseline ECG, with angina

- **Severe chest discomfort**

- **2nd or 3rd degree heart block**

- **Severe bronchospasm**
REVERSING ADENOSINE ACTION

- Majority of symptoms resolve within 30-60 sec of stopping infusion
- Chest Pain: Nitroglycerine 0.4 mg sublingual; repeat 3 X every 5 mins - Check BP
- Treat bronchospasm with Proventil inhaler or Albuterol nebulizer
- Slow infusion of Aminophylline 50 – 250 mg IV---- Do not inject radiotracer after aminophylline
  - Note: Aminophylline may increase risk of seizure
Reversing Regadenoson Action

- Slow infusion of Aminophylline 50-250 mg IV (50-100 mg over 30-60 seconds). Do not inject radiotracer after aminophylline
  - Note: Aminophylline may increase risk of seizure
- Chest Pain-Nitroglycerine 0.4 mg sublingual; repeat 3 X every 5 mins-Check BP
- Treat bronchospasm with Proventil inhaler or Albuterol nebulizer
### Dipyridamole

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<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td><strong>Onset of action:</strong></td>
<td>2 minutes</td>
</tr>
<tr>
<td><strong>Time to peak effect:</strong></td>
<td>average 6.5 minutes</td>
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<tr>
<td><strong>Vasodilator effect:</strong></td>
<td>20-40 minutes</td>
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<tr>
<td><strong>Half life:</strong></td>
<td>elimination 10-12 hours</td>
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**Xanthine (caffeine and theophylline)**

antagonize effects of Dipyridamole

**Oral Dipyridamole**

has little or no effect on potentiating the effects of IV Dipyridamole
Contraindications

- Symptomatic hypotension
- Unstable angina
- Recent myocardial infarction
- Congestive heart failure
- Previous sensitivity to Dipyridamole
- Use of caffeine (24 hrs) and theophylline (48 hrs)
Termination

- **Hypotension**
  - Systolic fall >20 mmHg
  - Systolic pressure <80 mmHg

- **ST-segment depression**
  - 3 mm without angina
  - 2 mm with angina

- **Severe CP, dizziness, dyspnea, headache, nausea, syncope, or dysrhythmia (regardless of BP and EKG changes)**
Reversing Dipyrdamole Action

- Aminophylline 75-125 mg IV. (Rapidly reversed with aminophylline by blocking adenosine receptors)
- Nitroglycerine-Check BP
- IV fluids
DRUGS & EXERCISE STRESS

- Adenosine / Exercise
  - Start low grade exercise then adenosine infusion

- Regadenoson / Exercise
  - Post EX

- Dipyridamole / Exercise
  - Start and finish dipyridamole infusion (4 min) then low grade exercise
The “OPEN SHAFT” stress test

Inspired by an unfortunate accident, this non-exercise test invariably produces satisfactory elevation of blood pressure and heart rate. Currently, awaiting approval by the legal department.
DOBUTAMINE

• **Action:**
  - Onset: 1-2 min
  - Half life: 2 min
  - Increase myocardial contractility and stroke volume-------
    increase work load and O2 demand
  - Increase HR and BP

• **Beta-blocking agents:**
  - may antagonize beta-adrenergic effect

• If target HR not achieved, give IV Atropine (glaucoma and prostate problems) to reduce vagal tone and increase heart rate
CONTRAINDICATIONS to DOBUTAMINE

- Hemodynamically significant LV outflow tract obstruction (IHSS)
- Atrial fibrillation - facilitates AV conduction
- Pre-existing severe hypertension
- Unstable angina
- Recent myocardial infarction
- Congestive heart failure
- History of ventricular tachycardia
- Aortic Aneurysm or Aortic Dissection
DOBUTAMINE

- **Endpoints:**
  - Achieving >85% of age-predicted HR
  - Angina with ischemic ECG changes
  - Significant arrhythmia
  - Significant side effects (nausea etc)

We want to make the stress test as realistic as possible
Reversing Dobutamine Action

• Majority of symptoms resolve within 2-3 min of stopping infusion
• Recovery time may be increased by 10-20 min if atropine is used
• If angina, hypertension-nitroglycerine (0.4 mg) (sublingual), or tachyarrhythmia – esmolol (10 mg), metoprolol (5 mg)-Think of using diltiazem (5m/ml)
ADJUNCT PHARMACOLOGIC AGENTS

- Reversal of adenosine or Regadenoson
- Increase heart rate (due to block)
- For hypotension
- To reduce blood pressure
- For bronchospasm
- For chest pain, hypertension, or tachyarrhythmia
- To reduce BP and HR
- For SOB or chest pain

- Aminophylline-125 mg slow IV push over 2 minutes may repeat in 5 minutes
- First ask the patient to cough
- Atropine -0.6-1.0 mg IV push
- Normal Saline -250 ml bag IV
- Labetatol- 10-20 mg IV.
- Proventil Inhaler (Aerochamber) -1-2 puffs
  Proventil solution for inhalation 0.083% for use with atomizer -2.5 mg/3ml
- Nitrostat 0.4 mg -1 tablet S.L. every 5 min x 3
- Metoprolol -2.5- 5 mg IV
- Oxygen – as needed (<90)
AHA Resting ECG Electrode Placement

- **V1**: 4th intercostal space, right of sternum
- **V2**: 4th intercostal space, left of sternum
- **V3**: midway between V2 and V4
- **V4**: 5th intercostal space, in the midclavicular line
- **V5**: same level as V4, at anterior axillary line (between V4 and V6)
- **V6**: in 5th intercostal space, in the midaxillary line
Atrial Fibrillation

Rhythm ➞ Irregular
Rate ➞ Atrial: 400-600 Ventricular: Variable
P Waves/ PR Interval ➞ Not distinguishable / Measurable

QRS Complex ➞ 0.04 to 0.12 sec (1-3)
OK Williams, we’ll vote .... how many here say the heart has four chambers?
**Identifying Heart Block**

On ECG, regularly occurring P waves; more P waves than QRS complexes = Heart block

Examine P waves immediately preceding each QRS complex
Does PR interval vary?

Yes

Examine QRS complexes –
Does R to R interval vary throughout strip?

Yes

Mobitz Type I (Wenckebach)
2nd degree AV block

No

2:1 or Mobitz II heart block
2nd degree AV block

No

3rd degree heart block

Use progressive PR intervals to confirm impression
Second Degree AV Block Type I (Wenckebach)
2nd Degree Heart Block (Mobitz I)

- Benign rhythm in stable patient, usually transient
- In unstable patient:
  - Atropine 0.6 to 1.0 mg IV bolus
  - Temporary pacemaker
- Causes: Acute inferior MI; pharmacologic stress with adenosine; disease of conduction system
- Alert:
  - Sudden onset of bradycardia
  - Decreased mentation
  - Hypotension
- Effects on study: if block develops and persists during adenosine infusion, discontinue infusion
Second Degree AV Block  Type II (High Grade)
2nd Degree Heart Block  
(Mobitz II – Classical)

- Pathologic rhythm – immediate treatment required; may progress to complete heart block
- Treatment:
  - Atropine 0.6 -1.0 mg IV bolus
  - Temporary pacemaker
- Causes: acute anterior MI; cardiac surgery; myocarditis; chronic degenerative disease
- Alert: sudden decrease in heart rate; decreased blood pressure; pale and diaphoretic; unconsciousness
- Effects on study: medical emergency, cancel study; if block develops and persists during adenosine infusion, discontinue infusion
Third Degree AV Block (Complete Heart Block)
3rd Degree Heart Block (Complete)

- **Pathologic rhythm** – immediate action required
- **Treatment:**
  - Atropine 0.6 to 1.0 mg IV bolus
  - Pacemaker
- **Causes:** Anterior MI
- **Alert:**
  - Sudden decrease in heart rate
  - Decreased blood pressure
  - Pale and diaphoretic
  - Unconsciousness
- **Effects on study:** medical emergency, cancel study.
  - If patient presents with pacemaker, may gate on pacer spike
  - If block develops and persists during adenosine infusion, discontinue infusion
Ventricular Tachycardia (VT)
Ventricular Fibrillation (VF)
Asystole

Lighten Up…
ECG CHANGES WITH CHEST PAIN

Subendocardial injury: ST depression

With subendocardial ischemia, the electrical forces are deviated toward the inner layer of the heart, causing ST depression.
ECG CHANGES WITH CHEST PAIN
Transmural (epicardial) injury: ST elevation

With epicardial ischemia, electrical forces are deviated toward the outer layer of the heart, causing ST elevation in the overlying lead.
Start CPR

One, two, three, BREATHE

He's dead, Jim
Effects of Cardiac Infarction, Injury and Ischemia

- Inversion of T waves / S-T depression
- Elevation S-T segment
- Q or QS waves
- S-T segment and T wave normalization
Myocardial Infarction

Acute
Days
(average 3-5 days)
ST segment elevation
Q wave

Recent
weeks-months
(average 2-6 months)
T wave inversion
Q wave

Old
months-years
(average >6 months)
just significant
Q waves
Skin Assessment During Cardiovascular Emergency

- Skin first organ blood shunted from to preserve vital organs.
- Look for the following:
  - Moist, Clammy, Cool skin
  - Diaphoresis on forehead and palms
  - Bead of perspiration on upper lip
  - Cyanosis, coolness of digits
Initial Assessment for the Patient with ACS

- Remember: TIME IS MUSCLE!!
- Obtain brief, targeted H&P
- Age, gender, signs & symptoms, pain presentation (PQRST format),
- Hx of CAD, risk factors present?
- Hx of Viagra, Ephedra?
- Assess vital signs, determine oxygen saturation

- Any signs of shock, pulmonary edema, Heart Rate >100 beats/min and SBP < 100 mm Hg?
- Establish IV access, ECG monitoring, lab draw for serum markers,
- candidate for reperfusion therapy?
- 12 lead ekg and present to MD for review
Other symptoms?

- Shock
- Pulmonary edema (rales > halfway up)
- HR > 100 beats/min
- SBP <100 mm Hg
Next Steps: MONA

- O2 4 L/min by nasal cannula for first 2-3 hours (titrate if pulmonary congestion, SaO2 < 90%)
- Aspirin 162-325 mg chewed (evaluate contraindications to ASA or Heparin)
- NTG SL or spray (ensure IV access, SBP > 90 mm Hg, HR >50 beats/min, no RV infarction)
- Morphine 2 to 4 mg IV if pain not relieved with NTG, may repeat q 5 minutes (ensure SBP > 90 mm Hg)
Summary

• Time is muscle
• Quick 10 minute assessment and 12 lead EKG within 10 minutes
• Ready for intervention: MONA
(I have a NMT that knows ACLS)

“I think you should be more explicit here in step two.”